



Multidimensional evaluation of tenants' temporal relocation during a renovation: A comparison between two case studies from Sweden

Downloaded from: <https://research.chalmers.se>, 2023-05-05 01:14 UTC

Citation for the original published paper (version of record):

Serrano-Jiménez, A., Femenias, P., Thuvander, L. (2019). Multidimensional evaluation of tenants' temporal relocation during a renovation: A comparison between two case studies from Sweden. IOP Conference Series: Earth and Environmental Science, 297(1). <http://dx.doi.org/10.1088/1755-1315/297/1/012014>

N.B. When citing this work, cite the original published paper.

Multidimensional evaluation of tenants' temporal relocation during a renovation: A comparison between two case studies from Sweden.

A Serrano-Jiménez^{1*}, P Femenías² and L Thuvander²

¹ Department of Architectural Construction I. University of Seville. Avenida Reina Mercedes 2. 41012. Seville (Spain).

² Department of Architecture and Civil Engineering. Chalmers University of Technology. Sven Hultins Gata 6. SE-412 96. Gothenburg (Sweden).

*E-mail: aserrano5@us.es

Abstract. This research focuses on the tenants' temporal relocation or stay in the home during renovation works and the property owners' possibility to refurbish with intense and global interventions. The study compares two renovation strategies applied in two residential neighbourhoods in Gothenburg, Sweden, built between the 1950s and 1960s. In one neighbourhood, the tenants stayed in their homes during the renovation works, and in the other neighbourhood, the tenants were relocated to other buildings for over six months. Retrofitting interventions, investment costs, rent increase, time periods and the constructive processes are considered for each renovation strategy, as well as the impressions of the tenants and property owner entities in each neighbourhood were collected. The results compare, through a report on the affordability and effectiveness, the pros and cons of a relocation or non-relocation strategy. This research offers a real and experimental comparison that reach to political, architectural, social and economic conclusions to facilitate the decision-making regarding the tenants' temporal relocation. Finally, it is also highlighted the need to involve the tenants in the design of effective renovation proposals.

1. Introduction

One of the major global and European challenges for this century is to renovate the existing building stock through urban regeneration strategies that should improve people's quality of life in the built environment [1]. Building renovation acquires a substantial role since more than 40% of the European housing stock is over 50 years old and 75% of buildings required for 2050 are already built [2]. These facts justify the need to develop new urban regeneration procedures and evaluate, from different dimensions, the effectiveness and adequacy of refurbishment actions in the housing stock [3].

During recent years, different studies have highlighted the importance of integrating the social and economic dimensions into the decision-making process of housing renovation. Mangold et al. [4] emphasised the need to consider the socioeconomic context in each renovation process in order to avoid the risk of creating social inequality due to rent increases in renovated buildings; Santangelo et al. [5] defined new challenges of building renovation through the influence of the occupant behaviour on the success and sustainable performance of different energy retrofitting measures; lastly, Femenías et al. [6] highlighted the possibility of carrying out partial renovations that achieve sustainable proposals with a social and economic responsibility.

In addition, there is a progressive aging population that is highly significant in Europe, where the number of people over 65 years old is expected to rise to one third of the European population by 2050 [7]. Thus, the consideration of an aging population is a relevant factor in urban regeneration, hence recent studies by Kovacic et al. [8] or Serrano Jiménez et al. [9] have promoted new procedures and renovation strategies specifically focused on the elderly requirements.

Regarding the construction process, one of the main influential factors in major renovation of housing is to decide to either carry out the works with the tenants staying in their apartments or relocating them, with the main restriction of the extra cost that the relocation supposes [10]. Nowadays, in different major renovation projects either of these strategies is chosen depending on the budget and the socioeconomic conditions of each region, and adapting the intervention levels depending on the investment size, the duration or the complexity of works, but without making an exhaustive comparison about the influence of the relocation or non-relocation duality [11–13]. However, all these facts usually limit the intervention levels to the point that housing renovation is reduced in order not to disturb the tenants. It can also be that deep renovation is not implemented, as temporal relocation is considered as complex and costly and challenging to manage [14]. Given these conditions, there is a need to specifically study the influence of this renovation factor in detail, and identify the advantages and inconveniences to be considered when deciding on relocation of the tenants or not during the works.

This research presents and compares the experiences of the renovation of two residential neighbourhoods in northern Europe that have followed different strategies in terms of the tenants' relocation during the process. In the first neighbourhood, the renovation proposal considered keeping the occupants in their apartments during the works. In the second neighbourhood, the tenants were relocated to other buildings for a period of more than six months. The main aim of the study is to evaluate the performance and the consequences of each project with respect to relocation but also the experiences of the elderly tenants. The paper aims at serving property owners support for decision-making based on the characteristics of the buildings, the tenants' perception of the renovation and by taking into consideration the property owners' ability to carry out a major renovation. Furthermore, the paper contributes to the knowledge building of sustainable renovation of the European housing stock, providing technical, economic and social understandings of the consequences derived from a relocation of the tenants or not.

The paper starts with a background description and justification of the topic, explains the methodology applied on both neighbourhoods, describes the two neighbourhoods, and ends with the presentation of the results reached through a multidimensional evaluation of the renovation strategies used in the two cases. The results lead to a series of conclusions about the advantages and disadvantages of relocating tenants or no by showing the impressions and opinions, from the survey results.

2. Methodology

This section presents the procedure used to evaluate and compare the two different renovation strategies, a medium renovation where the tenants stay during the renovation works (Case Study 1), and a deep renovation with relocation of tenants (Case Study 2). Figure 1 shows a graphic outline for the procedure to be performed, including the analysis factors that are taken into account for each case study in the multidimensional comparison and evaluation of the two neighbourhoods.

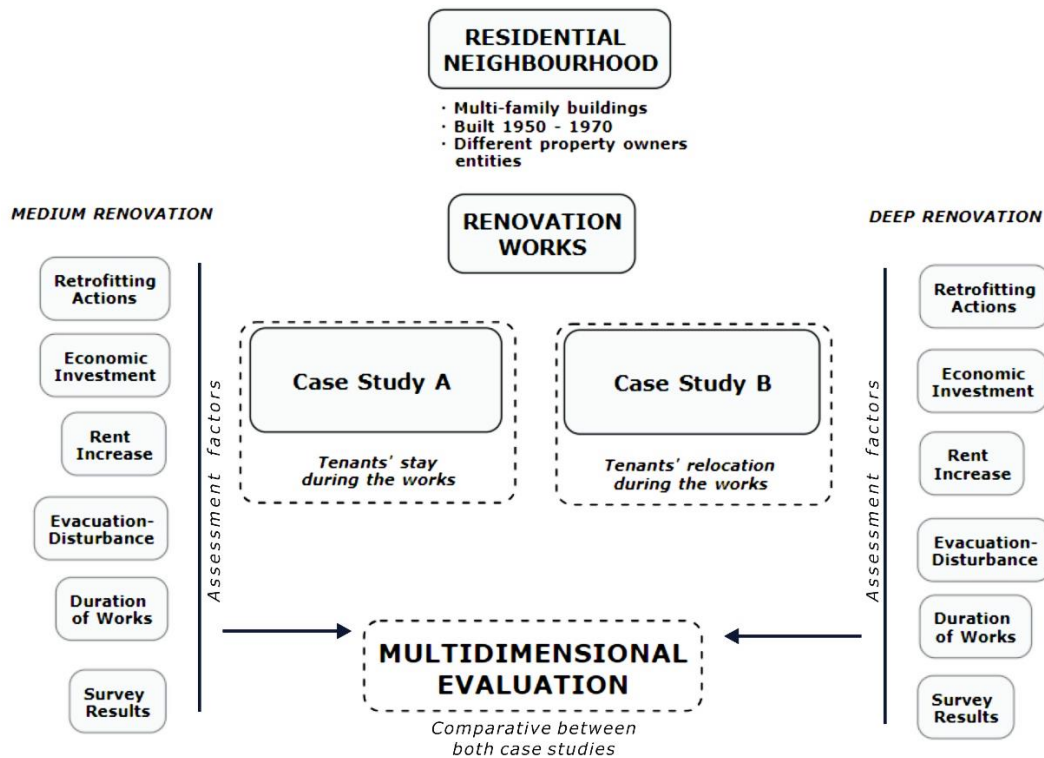


Figure 1. General outline of the procedure developed in this research.

The outline also defines the scope of application, two residential multi-family neighbourhoods, built between 1950 and 1970, and owned by two different semi-public property owners. For each neighbourhood data on retrofitting actions, investment costs, rent increase, evacuation conditions and the duration of work were collected. An analysis of these technical, economic and social aspects were accompanied by the results of a post-renovation questionnaire carried out among the tenants.

The data from the two cases were gathered through interviews, meetings, and e-mail contact with representatives of the property owner entities. These data were complemented with basic diagnosis procedures on the location, and the questionnaire. The research has been developed thanks to the collaboration of a research team made up of architects from universities in two countries in northern and southern Europe, bringing in knowledge from the two different countries in order to find common references and strategies for housing renovation. Therefore, this multidimensional evaluation procedure should be applicable in any other residential neighbourhood as a means to assess the feasibility of relocation, depending on the socioeconomic context of each property owner and the demands of the occupants.

3. Case studies

The case areas are two neighbourhoods with multi-family buildings which are located in the city of Gothenburg, Sweden. In Sweden, where around 50% of the apartments in multi-family buildings were built between 1941-1975 [15], there are many similar residential neighbourhoods facing the same needs for renovation. The two studied neighbourhoods are currently in a similar renovation phase, where some of the buildings have already been renovated and others are in the early design stage of a renovation. The two case studies areas are defined below:

A) A residential area composed of lamellar and tower block buildings that were built in 1950. The buildings that are renovated consist of several lamellar buildings of three storeys with over 200 apartments. Each building has five access portals with six apartments per staircase or nine apartments, if it is the corner. The property owner A decided to keep the tenants in their homes during the works. Figure 2 illustrates the kind of typology of buildings in area A.

B) A residential area composed of several larger lamellar buildings that were built in the early 1960s. Each building had initially 12 storeys and four entrances with independent staircases. So far, two buildings have been renovated comprising around 200 apartments. The property owner B decided to move the tenants to other residential buildings, which they own, during the renovation works. Figure 3 illustrates the kind of typology of buildings in area B.



Figure 2. Generic picture of the buildings in Case A.
Photo: Authors



Figure 3. Generic picture of the buildings in Case B.
Photo: Authors

4. Results

This section presents the results corresponding to each case study in two different subsections. Subsection 4.1. presents the multidimensional analysis of each renovation including several technical and economic factors, and subsection 4.2. presents the results of the questionnaire.

4.1. Multidimensional evaluation

Table 1 and 2 define and characterise the renovation works carried out in the selected neighbourhoods. Each table presents basic information about the neighbourhood and describes a sequence of the assessment factors related to the renovation strategy, the economic consequences and the development of the works.

Table 1. Renovation works in Case A.

Case A (without tenants' relocation)			
Location	Year of construction	Buildings (reference building)	Apartments (per building)
Gothenburg (Sweden)	1950	7	33
Storeys	% of elderly (area)	Annual rent (before, average)	Floor area per apartment (average)
3	23%	105€/m ²	64m ²
Assessment factors			
Retrofitting actions	Medium renovation with retrofitting actions mainly applied in the building envelope, the wet rooms of the apartments, new electricity, and HVAC systems. The actions were: <ul style="list-style-type: none"> • Building envelope: new plastered, isolated façade system adhered to the existing brick facade and replacement of the windows. • Bathroom: complete renovation with the replacement of pipes and new sanitary elements and tiles on floor and walls. • Kitchen: new electricity, new fan, the tenants can either keep the old furniture or make changes with they pay for separately. • Ventilation: new ventilation with heat recovery system (FTX) in each building. 		
Investment costs	Total cost of the intervention of 360,000€ for each building, or an approximate cost of 10,800€ for each apartment or a ratio of 170€/m ² .		

Rent increase	An increase in the pre-established rent of 23% is applied after the renovation, which means an annual increase of 22€/m ² .
Time period	The total time of the renovation in the neighbourhood was one year, the period of renovation works inside the apartments while the tenants resided was 10 weeks.
Evacuation - Disturbance	The renovation process of the façade was mainly carried out from the outside, the windows were replaced from inside the apartments. The bathrooms and kitchens were renovated progressively and sequentially in each apartment, and led to a short temporal relocation of the occupants. In the most complicated situations, there was no access to the bathroom and kitchens for two weeks and there were water cuts for up to two days.

Table 2. Renovation works in Case B.

Case B (<i>with tenants' relocation</i>)			
Location	Year of construction	Buildings (reference building)	Apartments (per building)
Gothenburg (Sweden)	1961	2	100
Storeys	% of elderly (area)	Annual rent (before, average)	Floor area per apartment (average)
12	18%	95€/m ²	69m ²
Assessment factors			
Retrofitting actions	<p>Deep renovation with retrofitting actions applied mainly in the common areas of the building and a new distribution inside the apartments. The actions were:</p> <ul style="list-style-type: none"> • Building storeys: addition of a new storey with apartments in the roof to increase the economic benefits of the intervention. • Common areas of the building: replacement of elevators and a complete adaption of portal access and staircases. • Bathroom: complete renovation with the replacement of pipes and new sanitary elements and ceramic coatings. Expanded size of the room with the redistribution. • Kitchen: complete renovation with the replacement of pipes and new distribution and materials. • Ventilation and heating system: new ventilation system with heat recovery (FTX) in each building and a new heating system and new radiators and pipes. 		
Investment costs	Total cost of the intervention including the tenants' relocation of 15,000,000€ for each building, or an approximate cost of 150,000€ for each apartment or a ratio of 2,150€/m ² .		
Rent increase	An increase in the pre-established rent of 45% is applied after the renovation, which is almost the double and means an annual rent increase of 43€/m ² compared to before the renovation. The increase in rents will be progressive during the first 15 years.		
Time period	The total renovation time reached 15 months, tenants were transferred to other buildings belonging to the same property owner for a period of seven months.		
Evacuation - Disturbance	The construction process was carried out mainly from the interior of the building, generating practically a new one, except in its structural elements. One of the main reasons why the property owner decided to evacuate the tenants was to install a centralised heating and ventilation system throughout the building, which made it impossible to have a building thermally adapted throughout the whole renovation.		

4.2. Survey results

This subsection presents the results of the questionnaire among the tenants in both neighbourhoods. This survey was carried out post-renovation, with the objective of understanding the tenants' satisfaction with the renovation process, including the relocation and their satisfaction with the ready renovation.

The questionnaire was designed by a multidisciplinary team and having the double intention of informing the property owners and increasing the general knowledge about renovation. The questionnaire, with 61 questions (28 about the results of the renovation, 18 about the renovation process, and 15 about the household), to be filled in anonymously, was put in the mailboxes. The questionnaire

also included a link to an on-line version. More details about the questionnaire can be read in the study developed by Femenías et al. [16].

The response rate was rather low (29 %), of a total of 392 households, 113 filled in the questionnaire. In Case A, the respond rate was 34,4 % (42 answers from 122 delivered questionnaires) and in Case B, 24% (65 out of 270). In both projects, 56% of the respondents were women and about 42% men. Figure 4 shows the age distribution among respondents in both cases. The distribution of age groups is rather equal, with a slightly higher number of +65 in Case B.

Figure 5 shows the satisfaction with the renovation (Yes or No) related to age groups. There seems to be more dissatisfaction with the renovation in Case B, and especially among elderly. On the one hand, this can be related to the deep renovation in general, with important changes and generating numerous annoyances in their usual residential environment. On the other hand, it could also be connected to the relocation or to the rent increase. According to the property owner, no more than 7 tenants in Case B actually moved back to the same building after the evacuation. 33 of the tenants moved to Case B from another building in the same property which is now about to be renovated. Furthermore, as many as 33 tenants, choose to move directly to another apartment in the area which the property owner provided instead of being evacuated and having to move twice.

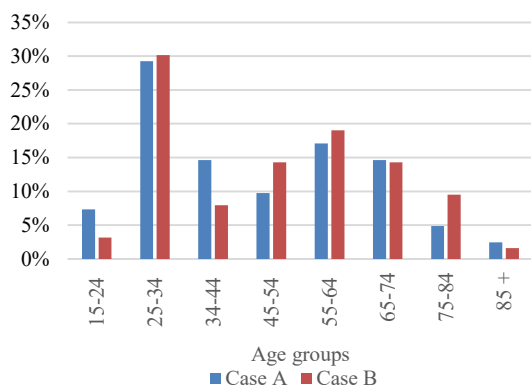


Figure 4. Age groups among respondents

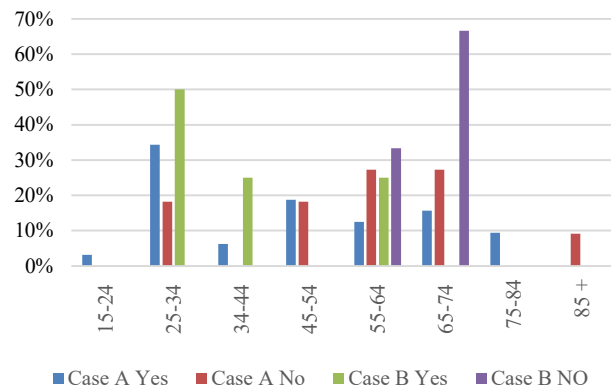


Figure 5. Satisfaction with renovation related to age group

Table 3. Main questions and responses regarding the renovation works in each neighbourhood.

Case A (without tenants' relocation)			
Questions	Answers ^c	% Yes	% No
1. Are you satisfied with the renovation?	N=57	73	27
2. Did you think you got sufficient information about the renovation?	N=56	78	22
3. Did you experience that you had influence on the renovation?	N=57	51	49
4. Did you live in a temporary dwelling during the renovation?	N=37	75 ^a	25
5. Where you satisfied with the relocation during the renovation?		86	14
Case B (with tenants' relocation)			
Questions	Answers ^c	% Yes	% No
1. Are you satisfied with the renovation?	N=57	57	43
2. Did you think you got sufficient information about the renovation?	N=56	50	50
3. Did you experience that you had influence on the renovation?	N=57	80	20
4. Did you live in a temporary dwelling during the renovation?	N=37	50	50 ^{b,c}
5. Where you satisfied with the relocation during the renovation?		100	0

^a Of these 75%, 22% says they arranged for another place to live themselves during the renovation.

^b This probably corresponds to tenants that have moved in after the renovation, they were never relocated.

^c Number of answers of both case studies. It is lower because those that moved in after the renovation didn't answer.

Table 3 shows the tenants satisfaction with the renovation and the relocation. With respect to the relocation, although Case A did not have relocation as a strategy, actually 75% answers that they actually

did relocate. Of these 22% arranged an alternative living themselves during the renovation, which shows the need for some people to find alternatives to avoid nuisance and discomfort during the works on their own. The free text comments testify about what the tenants' experiences as an impossibility to stay in their apartment during the works. The comments show that some tenants have approached the property owners with requests on an evacuation apartment, and some managed to get that. Those with small apartments (no separate bedroom), health conditions or night shift work were in priority for the temporal relocation arranged by the property owner. Regarding satisfaction, Table 3 also shows that residents of Case A are more satisfied (73%) with a medium renovation strategy compared to residents of Case B, with lower satisfaction (53%) despite being a deep renovation strategy.

Focusing on aspects that created nuisance for the tenants (Table 4), it is only dirt and dust that corresponds to both cases. In Case A, having no access to private bathrooms and kitchen, disorder, noise and strangers in the apartments were often noted by the respondents. In Case B, the relocation, the length of the process, and "other" scored high besides no opinion which could indicate that those respondents moved in after the renovation. Only one indicated that moving in after the renovation was this "other" reason.

Table 4. Aspects which has caused the most nuisance for the tenants in each case.

Aspects	Case A	Case B
Dirt/dust	16%	10%
No access to private bathroom	12%	0%
Disorder	10%	0%
Noise	9%	0%
Strangers in the apartment	9%	0%
No access to private kitchen	9%	0%
Length of the renovation process	7%	10%
Lack of information	5%	0%
The relocation	5%	10%
No opinion	5%	50%
Other	5%	10%
Strangers outside the apartment	5%	0%
Limited access to common areas	3%	0%
Light in the apartment	0%	1%

Regarding information and experienced influence. In Sweden, rents, in both public and privately rented housing, can only be increased if the original qualities or living standards of the apartments are improved. The rent increase is negotiated between the property owner and the Swedish Tenants' Association and includes the active approval by all tenants for interior changes in the individual apartment and the approval of 50% of the tenants for standard raising of common facilities.

Our results show that the almost 80% of the tenants in Case A think that they had sufficient information about the renovation. However, they are divided 50-50 about their experience of being able to influence the renovation, the level of interventions etc., or not. In the free text one tenant in area A says that there was even too much decision to be taken by the individual tenant at the same time as the real choice was very limited to pre-defined solutions. Other found the actual freedom of choice unclear. In Case B, 50% think that they had good information and 50% not, but as many as 80% think that they could influence the renovation. Something which has to be considered with the answers of the questionnaire, is that the authors had a rather low respondent rate and that and not all of the respondents did answer all questions, giving a lower response rate to some these.

Although the tenants witness about problems during the renovation process, in general, they recognise the improvement after the renovation. Counting both areas, 72%, think that the renovation was necessary.

5. Discussion

The two cases show two different renovation strategies. The strategy carried out in Case A aims for a new service expectation of around 15 or 20 years while the strategy developed in Case B is a profound renovation with a long-term perspective, with a service expectation of at least 50 years.

Regarding the financial investment, it could be understood as an excessive cost in the strategy carried out in Case B, since the total investment is around one million euros for a building with 100 apartments. It also requires an unusual availability of empty apartments to relocate so many residents. This action demands significant resources from the property owner. However, this action enables a deep renovation of the building, with changes that allow for a complete regeneration of the interior in order to meet the functional and social requirements of the 21st century. In contrary, the investment carried out in Case A has been typical for a medium renovation, taking care at all times of the excess in spending and carrying out the most important adaptation and repair operations to adapt the buildings to the current requirements. In addition, in Case B, the duration of the works has been extended to a higher number of months in order to carry out important works in the building with the guarantee of not disturbing the tenants. In Case A, the renovation duration has been adjusted to reduce the inconvenience and introduce the necessary benefits in the shortest possible time. Case A demands a much greater optimisation in the planning of the works.

Regarding the rents, both case studies have experienced an increase in the rent, but at different rates. In Case B, a progressive increase of 45% with respect to their previous rent will be much more difficult to assume for the tenants. In this sense there is a duality between the architectural benefit, in terms of modernisation of carrying out a deep renovation, and the doubling of costs for the tenants. In the initial processes, a mutual agreement needs to be reached between the property owner and the tenants.

The renovation involves a process of discomfort and inconvenience for the occupants that can be modified and reduced according to the relocation or not of the tenants during the works. However, it has been found that in both cases there are disturbances for the tenants in one way or another, and that even in Case B many of the respondents (corresponding to no more than 34% of the total tenants) were actually relocated as well but for a shorter time period. In Case A, the tenants had to endure noise, discomfort, and the lack of access to some basic services in their home for some period of time. On the positive side they could, in most cases, stay in their permanent homes, without breaking the social tie and without making the extra effort that a displacement to a new residential environment implies. In Case B, the tenants have been able to avoid the inconveniences directly linked to the works, but have had to accept, well in advance, a move to another home with the inconvenience of packing and unpacking in a lengthy process, and having to adapt to a new habitat.

Since there is an aging population that exceeds 23% in housing area where Case A is located and 18% where Case B is located, this research has also a specific focus on the tenants' age as a determining factor in the decision-making regarding the relocation [15]. Although one might think the most appropriate strategy is to relocate the tenants to reduce the impact during the work in this vulnerable population, one of the most counterproductive factors in this population is to abandon their homes for temporary permitting rehabilitation operations [17]. These circumstances generally lead the elderly to reject deep renovations, due to apathy to a long and expensive process and for refusal to break the bond and attachment to its place, which are very important psychosocial aspects highlighted in other research. In fact, the results of the questionnaire carried out have shown an increase in the percentage of non-satisfaction in this population sector for Case B, where a deep renovation has been carried out. Therefore, this research suggests that it is important to have a prior design process with the participation of tenants through meetings or surveys [18].

6. Conclusions

This research has carried out a comparison between two real renovation projects and studied the experiences of housing renovation applying two different renovation strategies, a relocation of the tenants during the renovations works and to let them stay at home. The impact of selecting one strategy or another has been analysed from the social, economic, and constructive point of view, and from the perspective of the property owners as well as the residents through a post-renovation survey. One of the main results of this research is that there is no unique and optimal strategy without having previously analysed the socioeconomic context of each case of application. It also illustrated the importance to consider the residents' views as well as their demographics, in order to create a technically, economically and socially balanced renovation proposal.

Focusing exclusively on the tenants' during the works, the research has shown advantages and disadvantages when integrating this premise in the design of a renovation. Relocating tenants allows to carry out deep renovations in buildings without exceeding the inconveniences to users and ensuring an improvement of comfort and well-being conditions inside the apartments. However, it has been shown that this is an expensive process, which implies a subsequent increase in rent to tenants and that requires a large initial investment with the availability of numerous housing units to relocate. This high rent increase also involves a risk for some of the socioeconomic vulnerable tenants not being able to move back to their former apartment and instead being forced to move to an apartment with cheaper rent. In addition, it has been expressed that the relocation itself can cause many inconveniences and nuisances in the tenants, breaking psychosocial links when moving their habitat to other environments for an extended period. Finally, this process has a higher incidence for elderly people since in this population sector the relocation generates a greater apathy and therefore a greater rejection, preferring simple and precise renovations that do not disturb the rhythm of their daily life. Therefore, this population sector deserves specific attention in the early-stage design of the renovation proposals, introducing particular plans in their relocation by reducing to the maximum the duration of relocation and without breaking the bonds with their permanent habitat.

The inclusion of the results of a post-renovation survey in both cases studies highlights the importance of integrating the occupants in the process of urban regeneration, through identifying their limitations, as well as preferences and opinions. In this case, the results have been related to satisfaction with each strategy and the demands and comments that these processes have generated. This research also demonstrates the utility of this tenants' valuation in an early design stage to develop a better structured process and taking into account the economic and social considerations in the final renovation proposal.

Finally, this research reveals the complexity of the housing renovation process and its multiple influencing factors. Some of the questions are difficult to answer in form of post-renovation survey, and therefore, more qualitative studies, like interviews or focus groups could provide complementary explanations about the tenants' experiences with the renovation.

The paper provides the basis for future research to develop a complete model for decision-making in residential renovation, according to different strategies, and to include various disciplines of analysis so that in each case it can be evaluated from a more exhaustively, assigned a value to each factor, what social, technical and economic impact each proposal has to develop a feasible and successful urban regeneration process.

References

- [1] World Health Organization 2015 *World report on Ageing and Health*. http://apps.who.int/iris/bitstream/10665/186463/1/9789240694811_eng.pdf.
- [2] European Commission 2018 Directive 2018/844 of the European Parliament and of the Council of 30 May 2018 amending Directive 2010/31/EU on the energy performance of buildings and Directive 2012/27/EU on energy efficiency *Official Journal of the European Union*.
- [3] European Union 2015 *Sustainable regeneration in urban areas urbact ii*. <http://urbact.eu/capitalisation-and-dissemination>.

- [4] Mangold M, Österbring M, Wallbaum H, Thuvander L and Femenias P 2016 Socio-economic impact of renovation and energy retrofitting of the Gothenburg building stock *Energy Build.* **123** 41–49. doi:10.1016/j.enbuild.2016.04.033.
- [5] Santangelo A and Tondelli S 2017 Occupant behaviour and building renovation of the social housing stock: Current and future challenges *Energy Build.* **145** 276–283. doi:10.1016/j.enbuild.2017.04.019.
- [6] Femenías P, Mjörnell K and Thuvander L 2018 Rethinking deep renovation: The perspective of rental housing in Sweden *J. Clean. Prod.* **195** 1457–1467. doi:10.1016/j.jclepro.2017.12.282.
- [7] European Commission 2015 *Population ageing in Europe. Facts, implications and policies* https://ec.europa.eu/research/social-sciences/pdf/policy_reviews/kina26426enc.pdf.
- [8] Kovacic I, Summer M and Achammer C 2015 Strategies of building stock renovation for ageing society *J. Clean. Prod.* **88** 349–357. doi:10.1016/j.jclepro.2014.04.080.
- [9] Serrano-Jiménez A, Barrios-Padura A and Molina-Huelva M 2018 Sustainable building renovation for an ageing population: Decision support system through an integral assessment method of architectural interventions *Sustain. Cities Soc.* **39** 144–154 doi:10.1016/j.scs.2018.01.050.
- [10] Egan M, Lawson L, Kearns A, Conway E and Neary J 2015 Neighbourhood demolition, relocation and health. A qualitative longitudinal study of housing-led urban regeneration in Glasgow, UK *Heal. Place* **33** 101–108. doi:10.1016/j.healthplace.2015.02.006.
- [11] Serrano-Jimenez A, Barrios-Padura A and Molina-Huelva M 2017 Towards a feasible strategy in Mediterranean building renovation through a multidisciplinary approach *Sustain. Cities Soc.* **32** 532–546. doi:10.1016/j.scs.2017.05.002.
- [12] Holopainen R, Milandru A, Ahvenniemi H and Hakkinen T 2016 Feasibility studies of energy retrofits. Case studies of nearly zero-energy building renovation *Energy Procedia* **96** 146–157. doi:10.1016/j.egypro.2016.09.116.
- [13] Baek C and Park S 2012 Policy measures to overcome barriers to energy renovation of existing buildings *Renew. Sustain. Energy Rev.* **16** 3939–3947. doi:10.1016/j.rser.2012.03.046.
- [14] Miltenburg E, Van de Werfhorst H, Musterd S and Tieskens K 2015 Consequences of forced residential relocation: Early impacts of urban renewal strategies on forced relocatees' housing opportunities and socioeconomic outcomes *Hous. Policy Debate* **28** 609–634. doi:10.1080/10511482.2018.1424722.
- [15] SCB 2018 *Statistics Sweden's switchboard*. <http://www.scb.se/en/>.
- [16] Femenías N, Forsemalm J, Jonsdotter L, Punzi E, Bogdanova E, Thodelius C and Granath K (Forthcoming) Residential movement patterns in connection to renovation of rented multi-residential housing: A pilot study. Submitted to SBE Helsinki 2019.
- [17] Ujang N and Zakariya K 2015 The notion of place, place meaning and identity in urban regeneration *Procedia - Soc. Behav. Sci.* **170** 709–717. doi:10.1016/j.sbspro.2015.01.073.
- [18] Kleit R G and Manzo L C 2006 To move or not to move: Relationships to place and relocation choices in HOPE VI *Hous. Policy Debate* **17** 271 – 308. doi:10.1080/10511482.2006.9521571.

Acknowledgments

The authors would like to thank the Spanish Ministry of Education and Research for financial support via the contract: “Formación del Profesorado Universitario” FPU2015/00070 granted to Antonio Serrano-Jiménez, and the financial support for the research stay EST17/00243 of the author at Chalmers University of Technology in Sweden. Authors also acknowledge the Swedish Research Council Formas, grant number 2013-1804, for the finances of SIREn, a National strong research environment on Sustainable, Integrated Renovation. This research is also possible due to the support of the “Institute of Architecture and Building Science” IUACC from the University of Seville (V-IUACC grants, mode B, 2018).